

Water Efficiency

Rapid development, rising population and reliance on a limited and variable water supply increases the importance of water conservation in Colorado. Drought conditions in recent years have heightened the potential environmental strain and negative impact produced by water scarcity. All building projects in Colorado should be encouraged to emphasize water efficiency in their design and operation. Minimizing water usage will reduce operational expenses and lessen the environmental burden on local water supplies. It is recommended that building projects pursuing LEED in Colorado attempt several, if not all, Water Efficiency Credits.



CH2M HILL Denver Campus

Courtesy: CH2M HILL

WE Credit 1.1: Water Efficient Landscaping, Reduce by 50%

In Colorado, this credit is readily achievable with a twofold approach: native or adaptive plantings, which require little or no supplemental water, and efficient irrigation. Recent municipal watering restrictions have given rise to the popularity, availability and acceptability of low water plants. Often, these types of plants and landscape designs are called, respectively, *xeric* or *Xeriscape*TM. Numerous xeriscape demonstration gardens can be found in locations all over Colorado and an increasing number of landscape architects have experience with xeric plantings and are excited to implement xeriscape design principles.

Xeriscaping provides an aesthetically pleasing alternative to more traditional, water-intensive landscaping, but may not be suitable to all applications. For instance, some drought tolerant grasses do not meet campus standards since they are not resilient in areas of high pedestrian traffic. Certain clients may wish to combine traditional and xeriscaping strategies by using traditional landscaping techniques in some areas and xeriscaping in other areas.

Another strategy which assists in achieving the Water Efficient Landscaping credits is the use of water efficient irrigation strategies. Strategies include low-volume or drip systems (water applied directly to the root zone through surface piping), sub-irrigation (water delivered to root zone through underground systems), and “smart” control systems (central/satellite controls, weather based, soil-moisture systems). The LEED calculator provides credit for “drip” or “other” systems as alternatives to the traditional sprinkler system. If “other” is selected, the landscape architect will need to provide the “irrigation efficiency” of the system. Many of these systems may have a higher first cost than a traditional sprinkler system, and may or may not provide operational cost savings depending on the local water usage rate structure. However, recent years have seen a trend to increase water usage rates by many Colorado municipalities, and many projects will benefit from lower water usage over the lifetime of the building.

QUICK FACTS

Implementation: Strongly recommended.

Historical Data: 79% of Colorado LEED certified projects have successfully earned this credit.



North Boulder Recreation Center

Rainwater harvesting is the process of intercepting stormwater run-off and putting it to beneficial use, such as irrigation. The diversion or harvest of rainwater is subject to Colorado law. Any rainwater harvesting strategy more sophisticated than simply positioning roof gutter downspouts in areas you wish to water may have legal barriers. Before developing a rainwater harvesting system, check with the Colorado Division of Water Resources and local building, zoning, and environmental departments to determine what legal requirements, plumbing requirements, local restrictions, neighborhood covenants or other regulations or guidelines might apply.

Similarly, graywater systems (i.e. systems that reuse water drained from baths, showers, washing machines and sinks) may present difficulties from a water quality perspective. Graywater is regulated under the State of Colorado Guidelines on Individual Sewage Disposal Systems and applicable county Individual Sewage Disposal System (ISDS) regulations. Graywater reuse systems require permitting and may trigger monitoring requirements.

Recommendations:

- Use the LEED calculator early to determine the project baseline irrigation water use and required improvements to reach the 50 percent water reduction. Incorporate water saving strategies into the initial landscape design to achieve the 50 percent water reduction with minimal design and overall project costs.
- Specify drought tolerant plants and efficient irrigation techniques.
- Check with the Colorado Division of Water Resources and your local building, zoning, and environmental departments before attempting rainwater harvest or graywater systems. These solutions may be illegal and/or and challenging.
- Include a maintenance specification or manual into the project documents to promote proper operation of the irrigation system and maintenance of the drought tolerant plants.
- Include a detailed narrative describing installed landscaping and the actual irrigation source for the plants.

Helpful Hints:

- When creating the LEED calculator baseline case, it is helpful to assume a reasonable worst case scenario for the Colorado climate. This is not to say that using 100 percent bluegrass in the baseline case is reasonable in our climate. Look to similar existing building types in surrounding areas or typical practices used by developers that have water intensive landscaping to establish a reasonable baseline.
- Campus applications may require revisions to campus standards to allow the native/adaptive plantings. Xeriscaping may not be applicable in all high-usage areas.
- Some native plants may not be appropriate for facilities where allergies or compromised immune systems are of primary concern.
- Non-potable water systems (untreated irrigation water) may be prone to problems with mineral deposits in irrigation piping and nozzles. Check with local installers on product maintenance records in local installations.

Examples:

- The North Boulder Recreation Center earned this LEED credit primarily by providing drip irrigation instead of sprinklers and reducing or eliminating landscaped areas from the original design. The final design also included an electronic, weather based control system.
- Boulder Community Foothills Hospital was also able to earn this LEED credit through proper landscape design.



Boulder Community Foothills Hospital

Starting a new LEED-NC project?

All new LEED-NC projects will register under version 2.2 (as of January 2006). Refer to the USGBC for complete information about version 2.2. Also, see Appendix C of this Guide for a quick overview of the changes from version 2.1 to 2.2.

Resources:

XERISCAPE COLORADO!, INC.

Xeriscape Colorado is a non profit membership group promoting creative approaches to water conserving landscapes. This resource includes example gardens in Colorado, workshops and more. Xeriscape is a registered trademark of Denver Water.

Website: www.xeriscape.org/

Colorado Office of Smart Growth

Waterwise Landscaping Best Practices Manual

This best practices manual, designed for communities along the Front Range, includes waterwise principals and guidelines, waterwise plant lists and more.

Website:

www.dola.state.co.us/smartgrowth/documents/WaterWise%20Landscaping%20Best%20Practices%20Manual.PDF

Denver Botanic Gardens, in partnership with Colorado State University

Denver Botanic Gardens, in partnership with Colorado State University and the green industry, are teaching people about the hundreds of varieties of plants that will flourish in our climate.

Website: www.ext.colostate.edu/

Website for Plant Select® plants:

www.plantselect.org

U.S. Environmental Protection Agency

Water Efficient Landscaping

This booklet describes the benefits of water efficient landscaping. It includes several examples of successful projects and programs, as well as contacts, references and a short bibliography.

Website: www.epa.gov/owm/water-efficiency/final_final.pdf

Colorado Springs Utilities

Offers a website for xeriscaping needs in Colorado, including a database of xeric plants.

Website:

www.csu.org/environment/xeriscape/index.html

Colorado State University

Cooperative Extension Gardening Online

Gardening online fact sheets including trees, shrubs, grasses and vines of Western Colorado

Website: www.ext.colostate.edu/pubs/garden/pubgard.html

Resources:

- Colorado Native Plant Society
- Colorado - The Colorado Natural Heritage Program
- Colorado Rare Plant Field Guide
- Irrigation Management: Types of Sprinklers

Colorado State University

Graywater Reuse and Rainwater Harvesting

This paper includes information on graywater systems, water quality issues surrounding graywater reuse in Colorado and water rights issues surrounding graywater reuse in Colorado.

Website:

www.ext.colostate.edu/PUBS/natres/06702.html

Green Industries of Colorado (GreenCO)

GreenCO is an alliance of seven trade associations representing diverse aspects of the plant and landscape industry dedicated to water conservation and water quality. GreenCO has robust Colorado-specific resources including Water Budget Calculator, Watering Guidelines, Reservoir Reports and Best Management Practices manual and trainings.

Website: www.greenco.org

Colorado Greening Government

Water Conservation and Water Quality

Information for Colorado state government and others on resources and assistance for water conservation and water quality.

Website:

www.colorado.gov/greeninggovernment/programs/water

WE Credit 1.2: Water Efficient Landscaping, No Potable Use or No Irrigation

This credit is achieved through either 100 percent non-potable water use, or no irrigation. While temporary irrigation can be used to establish plantings during a typical period of two years, it must then be removed to earn credit. Furthermore, only above ground flexible piping can be used in the irrigation systems during this establishment period.

It is possible to use non-potable water, which is defined as water that is not suitable for human consumption, for irrigation on some projects. Projects may have one waterline for building water use and a second waterline for non-potable irrigation water. In Colorado, many larger landscape sites like golf courses, parks and industrial sites are irrigated with non-potable water. Currently, the USGBC is not entirely consistent in their requirements for non-potable water. In general, any type of water that could be treated (e.g. streams, lakes, rivers), or is municipally provided cannot count towards the credit. Look to future CIRs for additional information on using non-potable water to earn this LEED credit.

Colorado receives about 12 to 15 inches of rainfall a year. This makes it difficult for many landscape designs, especially large ones, to survive without supplemental irrigation. Furthermore, standing bodies of water such as detention ponds are sometimes *not* considered advisable for safety or health hazard, e.g., they are places for mosquitoes to breed. If deemed acceptable, a detention pond can also contribute to earning Stormwater Management SSc6.1.

Recommendations:

- It is difficult for most projects to completely eliminate the need for some form of irrigation from their landscape design. Projects that have earned this credit either have access to non-potable irrigation water or have very limited or no landscaping included in the project budget.

QUICK FACTS

Implementation: Recommended.

Historical Data: 36% of Colorado LEED certified projects have successfully earned this credit.



CH2M HILL earned this credit for all three buildings. The Meridian International Business Park wastewater system provides non-potable water for irrigation to all needs on the campus in Englewood.

Courtesy: CH2M HILL

- One of the most effective measures for reducing water consumption is to educate the maintenance staff. While this will not earn LEED credit, requiring climate appropriate watering schedules that include deep soakings rather than frequent light sprinklings, system maintenance to minimize leaks, etc. will significantly contribute to operational water savings.

Helpful Hints:

- Research the potential health issues associated with using graywater for irrigation. Graywater is not always a safe product. It can contain bacteria and other potential pathogens. Some plants are not suited well for graywater irrigation; therefore, it is important to pay careful attention to plant selection and tolerance to graywater irrigation.
- The USGBC has strict standards on what can be considered usable graywater or non-potable water for irrigation. Any type of water that could be treated (e.g. streams,

lakes, rivers), or is municipally provided non-potable water, cannot count towards this credit. Research the proposed design carefully for consistency with the LEED requirements. (Version 2.2 does allow municipal non-potable water for this credit.)

- The USGBC does not consider hard-piped underground irrigation lines to be acceptable as a temporary irrigation system; however, hose connections and above ground drip systems can be used for up to two years to get plants established.
- When designing a site, consider the addition of a detention pond or the use of an existing pond to provide a source of untreated, non-potable water for landscape irrigation. This credit may be complimentary to a detention pond used for storm water management, SSc6.1.
- Using graywater for irrigation purposes can only be implemented via drip or rotary head irrigation systems. Spray systems are prohibited due to potential health hazards.

Examples:

- All three CH2M HILL buildings earned this credit by using non-potable water provided to all sites within the Meridian Park development. The non-potable water is the treated water exiting from the central wastewater treatment plant, which supplies 100 percent of the CH2M HILL buildings' irrigation needs. Water efficiency in irrigation was further encouraged by the water budgets established by the Meridian Business Park. As a result, in much of the landscaping, drought-resistant plants were selected.
- Poudre School District built a detention pond that provides untreated water for irrigation for four sites: Zach Elementary School, Fossil Ridge High School and two city recreation fields. Although this meets the intention for the LEED credit, they were not able to achieve the credit because they still need approximately 25 percent of their irrigation water from the municipal supply.
- The North Boulder Recreation Center decided against a detention pond due to child safety concerns.

- Colorado Department of Labor & Employment eliminated the need for irrigation for the narrow strip that could have been landscaped, by using rock exclusively. The project did not earn this credit. Though this is a water-saving strategy, the ruling is based on the LEED philosophy that *credits are awarded for action*, rather than inaction.

Resources:

See Water Efficient Landscaping credit (WEc1.1).

WE Credit 2: Innovative Wastewater Technologies

This credit requires a reduction in wastewater, specifically in the amount of potable water used for sewage conveyance. The two main strategies for earning this credit are reducing the need for sewage conveyance through the use of water-saving flush fixtures and/or meeting the reduced conveyance load through the use of non-potable water such as graywater or stormwater. Before pursuing the non-potable water strategies, the project team should carefully research all health code issues related to using non-potable water for flush fixtures.

Recommendations:

- Reducing water used for flushing is often the most cost-effective way to achieve this credit. Consider no-water urinals and dual-flush toilets.
- Even if project teams elects not to pursue the credit, no-water urinals may be an effective strategy to implement.
- Innovative mechanical or plumbing engineers are essential to achieving this credit.
- Investigate the potential design risk of reduced sewage flow due to the reduction in water for conveyance.

Helpful Hints:

- While no-water urinals have gained acceptance in several projects, the majority of Colorado projects are not currently willing to incorporate composting toilets. Coordinate with plumbing inspector in early design stages to ensure they are acceptable in your project's permitting region.
- Limited information is available since few projects elect to pursue this credit. As fixture types and sewage conveyance technologies improve, there may be additional opportunities to pursue the credit.
- Significant opportunities may exist through the use of biodigesters and Living Machine technologies, which have been used successfully in other regions. For example, the Lewis Center at Oberlin College in Ohio uses a Living Machine to process wastewater from all sinks and toilets in the building.

QUICK FACTS

Implementation: Worth considering.

Historical Data: 0% of Colorado LEED certified projects have successfully earned this credit.



No-Water Urinals
Falcon Waterfree Technologies



Dual Flush Toilets
Courtesy: Coroma

Examples:

- New Belgium Brewery is striving to treat 100 percent of its wastewater onsite through biodigesters at its existing facility in Fort Collins. The system has the added benefit of generating biogas to fuel a generator that can be operated during peak times to cut electricity costs.

Resources:

Colorado State University

Graywater Reuse and Rainwater Harvesting

This paper includes information on graywater systems, water quality issues surrounding graywater reuse in Colorado and water rights issues surrounding graywater reuse in Colorado.

Website:

www.ext.colostate.edu/PUBS/natres/06702.html

NSF International

Wastewater Treatment Systems

This resource includes links to provide consumers with general information about septic systems, as well as alternative wastewater systems. NSF International is an independent, non profit organization that certifies products and develops standards for food, water, air and consumer goods.

Website:

www.nsf.org/consumer/wastewater_treatment_systems/index.asp?program=WastewaterTreSys

High Performance Buildings Database

Oberlin College Case Study

Information and photos of the Living Machine at Adam Joseph Lewis Center for Environmental Studies, Oberlin College, Ohio. (Pictured below.)

Website:

www.eere.energy.gov/buildings/database/overview.cfm?ProjectID=18



Courtesy: Robb Williamson, NREL PIX 10870

WE Credit 3.1 and 3.2: Water Use Reduction, 20% or 30% Reduction

Most projects have the opportunity to earn one or two credits for water use reduction under this credit. Well thought-out specification and design by the plumbing engineer can easily result in a 20 percent savings, which is the threshold required to earn WEc3.1. The plumbing engineer should complete the LEED calculator early in the design process to see what additional strategies could be specified to achieve the 30 percent savings to earn the second Water Use Reduction credit. In addition to the flow rates for fixtures, automatic controls, such as infra-red sensors and flow restrictors, contribute to credit achievement. Finally, the USGBC has a clearly established precedent for awarding an Innovation in Design credit to a project which achieves a 40 percent overall water use reduction.

Recommendations:

- Complete the LEED calculator early in the design process to determine the project's potential for water use reduction. Design and specify fixtures in the original design to meet desired water savings threshold.
- Advise project facilities and maintenance departments to speak with existing facilities departments with successful water saving strategies to help quell concerns over maintenance and operations issues that may be associated with certain fixtures.
- Projects should consult/involve local code officials early in the project to ensure waterless fixtures will be approved for the project.
- Projects that have had doubts about the effectiveness and reliability of waterless fixtures have included stub-outs for flow fixture replacement. It should be noted that this eliminates some of the potential financial benefits of reducing piping and drains, but does offer peace of mind.
- There may be a slight increase in health risks (such as legionella bacteria) with the use of aerators or flow restrictors.
- Simple strategies include, but are not limited to, aerators, 0.5 gallon per flush urinals, and low-flow shower heads or water closets. More aggressive strategies may include pressure assisted water closets, waterless fixtures and dual flush water closets.

QUICK FACTS

Implementation: Strongly recommended for both WEc3.1 & WEc3.2.

Historical Data:

64% of Colorado LEED certified projects have successfully earned WEc3.1.

29% of Colorado LEED certified projects have successfully earned WEc3.2.



University of Denver Ricketson Law Building
earned both credits for water use reduction
*Courtesy: Mary Weikert for the University of Denver
Sturm College of Law*

Examples:

- The Ricketson Law Building at the University of Denver achieved both credits by using a wide variety of water-saving strategies, including no-water urinals.
- Aspen Skiing Company's Snowmass Golf Clubhouse uses Australian dual-flush toilets, in addition to low-flow shower heads.
- Boulder Community Foothills Hospital installed many water saving strategies in public areas but not in the medical areas, due to health code requirements, and did not attempt this LEED credit.

Resources:

U.S. Environmental Protection Agency

Using Water Efficiently: Ideas for Industry

This paper is a resource that includes strategies for industrial projects to reduce water consumption.

Website: www.epa.gov/owm/water-efficiency/industry.pdf

U.S. Environmental Protection Agency

Using Water Efficiently: Ideas for Commercial Businesses

This paper is a resource that includes strategies for commercial projects to reduce water consumption.

Website: www.epa.gov/owm/water-efficiency/commercial.pdf

U.S. Environmental Protection Agency

Clean Water State Revolving Fund

Clean Water State Revolving Fund (CWSRF) programs provided about \$4 billion annually in recent years to fund water quality protection projects for wastewater treatment, nonpoint source pollution control, and watershed and estuary management. .

Website: www.epa.gov/OW-OWM.html/cwfinance/cwsrf/index.htm

U.S. Environmental Protection Agency

Funding Water Efficiency Through the State Revolving Fund Program

America's largest water quality financing source.

Website: www.epa.gov/owm/water-efficiency/wef_final.pdf

Whole Building Design Guide

No-Water Urinals: A Technical Evaluation

Provides list of manufacturers, and information about codes and test data. (March 2003)

Website: www.wbdg.org/pdfs/nowaterurinals_techeval.pdf